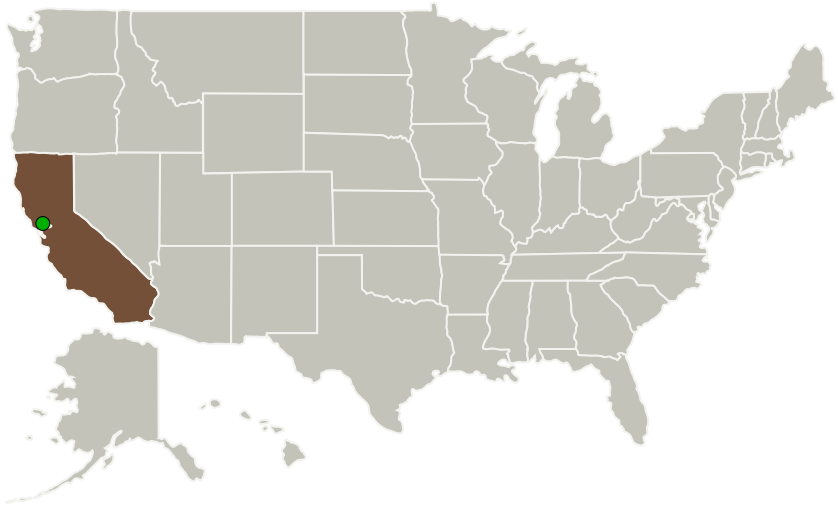
Hummingbird - A Very Low Cost, High Delta V Spacecraft for Solar System Exploration, Phase I

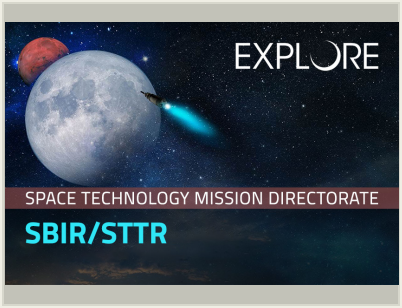
Completed Technology Project (2012 - 2012)

Project Introduction

Based on Microcosm's development of a high delta-V small Earth observation spacecraft called NanoEye, with a planned recurring cost of $2 million, Microcosm will develop a new class of very low cost, light weight, extremely capable spacecraft for NASA science and exploration missions, from Earth orbit to deep space. This new spacecraft, called Hummingbird, is based on an all-composite, unibody structure in which the propellant tank is the structure. The first payload would be the 2.9 kg, 9.25-inch aperture diffraction-limited telescope built by ITT. Space-qualified 1-lbf thrusters from AeroJet weighing 8.7 gm each provide both orbit control and very rapid attitude maneuvers. The current NanoEye spacecraft has over 2.5 km/sec of delta-V, although delta-V can be increased considerably. The wet mass of the spacecraft is about 80 kg in its present configuration. The spacecraft uses CubeSat components, which are evolving rapidly to become more robust and capable. Multiple Hummingbirds can work together as a system and also provide robustness against system failures. Updates with new equipment can be introduced 3 to 10 times quicker than with traditional space systems, allowing responsive mission implementation at a cost and time scale not possible with traditional space missions.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Microcosm, Inc.	Lead Organization	Industry Women-Owned Small Business (WOSB)	Hawthorne, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138601)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Microcosm, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

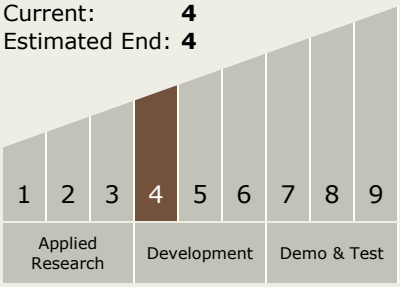
Carlos Torrez

Principal Investigator:

Richard Van Allen

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System